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South Africa, Water & Sanitation

Time's Ticking

Off the southernmost tip of Africa thereby lies the golden land of beauty, prosperity, and divine lines. South Africa, better known as Mzansi to the natives, is arguably the most industrially developed nation of Africa ("South Africa"). The warm heart of Africa has overcome a multitude of problems in the last century. The systematic use of apartheid that separated the black natives from the white colonizers was used against the citizens and lasted throughout several decades. Even with apartheid, the nation has regrouped and grown for the better and allows them to claim the position of being the most industrially advanced. While apartheid ceases to exist today, a new dreadful obstacle has emerged that if not controlled, will in the end affect every single being in the country. With being such an advanced country, it is almost insanity to believe that the country is currently dealing with a major water crisis. South Africa, and more specifically Cape Town, is just months away from Day Zero, where all sources of tap water will be shut off throughout homes and businesses in order to preserve the remaining usable water the country is drastically lacking. Due to the country being deprived of such a necessity, this has forced many to intake and use contaminated water in their day-to-day's, opening a door to pain, disparity, and illness. The downfall of South Africa will remain inevitable unless changes are made. No country deserves to be deprived of a human necessity when there are methods in place that can easily prevent that. New technologies of today, such as solar-powered water purification systems, have helped countries in similar shoes of South Africa. With the appropriate funding, the addition of solar-powered purifiers could allow for an immense increase of usable, sanitized water for the all citizens of South Africa who are currently experiencing the water crisis.

South Africa resides as one of the largest countries on the continent with a population of 55 million ("The World Factbook: South Africa"). According to Trading Economics, 65% of that population exists in the urban part of the country, and 35% of the population exists in the rural end. More than half of South Africans live towards cities and populated areas, while the others live in the countryside. The population resides across the subtropical climate of the country. The country experiences sunny days and cool nights ("The World Factbook: South Africa").

The country is built upon semi-arid land, in which the land has room for little vegetation and is dominated mainly by grasses and shrubs. ("Chapter I: The Arid Environments"). According to the CIA Factbook, only about 9.9% of the country's land is cultivated and can be used for farming. Maize, wheat, sugarcane, and fruit exist as the top four major crops; other crops the country exports include vegetables, beef, poultry, wool, and dairy. The crops are grown across various farms. According to Reuters, an average "small-scale" farm size in South Africa is 1000 hectares;. large farms can go up to 12,000 hectares.

The government exists as a parliamentary republic were elected representatives make up a parliament and work alongside the executive branch of government ("Parliamentary Republic"). There is a head of state who oversees the entire government. Jacob Zuma led South Africa as the head of state until February of

2018, where he resigned ("Jacob Zuma")**.** As the physical and political structure of the country has been revealed, it is important to take a look into the lives of those who live in the country.

The people of South Africa have strong ties to their culture. In the country, a typical family unit exists of a mother, father, and their varying amount of children; this is referred to as the nuclear family or immediate family in other cultures. ("South African Culture".) It is not uncommon to see some members from the extended family staying with the nuclear family. Polygamy is also seen on occasion, where a husband has more than one wife and often has children with each of them. Each of the families are housed in small dwellings near where the husband resides.

South African families often follow a similarly structured diet. With the water crisis in play, it is no question that South Africa lacks in the stability of their food security. Due to that, families have limited access to diverse food groups and often repeat meals. South Africans mainly intake and base their food primarily from starches, such as maize ("Typical Diet in South Africa"). For breakfast, a common meal is mieliepop, or maize porridge and is eaten plain. For lunch, bread is served with morogo, or African spinach. Lastly for dinner, a repeated mieliepop and morogo is served, but this time with a portion of meat or poultry. On special occasions, rice will be served as the starch supplement instead of mieliepop as it is considered a luxury. Making food for the family is just one of the plentiful home responsibilities for those who work around the home. However, many South Africans pursue actual careers and hold jobs that are outside of the home.

In South Africa, there are multitudes of careers a citizen can pursue. The different careers are divided into sectors based on their section in the workfield. According to BusinessTech, examples of sectors are architecture and engineering, building and construction, warehousing and logistics, information and communication technology, medical and health, finance, marketing, sales, manufacturing and assembly, admin and office support, and countless others. Within those sectors, jobs with different skill levels will receive higher or lower ranges of wages comparable to others.

The wages are under the South African currency of rands. For example, in the medical and health sector, a hospital management worker makes about R61,000 or about $5300 each year while a dietician in the same sector makes roughly about R15,000, or $1300 each year. ("South African Salaries") In addition to just the skill level determining the level of pay one will receive, pay wages also increase the higher one is in seniority. For example, continuing in the medical and health sector, the average intermediate pharmacist in 2017 made at most R36,000, or $3124 dollars, per year while the average senior pharmacist made almost R50,000, or $4340 dollars per year ("South African Salaries"). Clearly, the value of employees who are more experienced in the job is emphasized, hence why there is a slight pay gap. But just as it is virtually everywhere in the world, receiving schooling is the biggest factor that determines whether one will get into a proper occupation.

The education system of South Africa follows a structure with four different levels of education: primary, middle, secondary, and tertiary. According to Classbase, school is compulsory, or mandatory for children up until 9th grade. Primary education is merged together with middle school: 6 years in primary, 3 years

in middle. In primary school, education is dedicated to general education and training and becomes increasingly intensified as children go through the system.

In middle school, various subjects that were brought in primary school continue to be taught. However, a twist of vocational training is added, in which some skills are steered into the direction of a particular occupational field that a child wishes to pursue after schooling. As middle school continues up until 9th grade, the mandatory level of schooling for children, students who complete middle school will receive a basic education and training certificate ("Education System in South Africa").

Secondary school begins from 9th grade to 12th grade; schooling at this point now often excludes the poorest citizens from attending because tuition and fees are now included for a student to attend the school. In secondary schooling, vocational training is much more prominent as students plan to prepare for their careers. After secondary schooling, a student may wish to enter tertiary education.

Tertiary education can be compared to as college or a university. At this level of education, the universities can award traditional degrees such as bachelors, doctorates, and masters degrees. According to Classbate, the oldest university in South Africa is the University of Cape Town and was built in 1829.

Health care in South Africa ranges from a very basic level which is offered free by the state, to a highly specialized care which is affordable by middle and high income workers. According to Brand South Africa, the care is divided into two sectors; private and public. The private sector once again caters primarily to the middle and high income workers and their care appeals to most of the country's top medical professionals. As for the public sector, which is makes up most of the country, it is receives inadequate and insufficient healthcare. The care is inaccessible to the majority of the public sector and has "suffered poor management, underfunding, and deteriorating infrastructure" ("Health Care in South Africa"). The government spends 40% of their expenditure on health, yet almost 80% of the population fail to receive proper health care services. This has caused a large population of the country to be rampaged with destructful diseases such as HIV, AIDS, and tuberculosis. The government is currently in motion of a plan to restructure their health care system that will reach to benefit all citizens unlike the current situation. Nonetheless, as the health care system with South Africa continues to crumble, there is little surprise to see the country faces such a crisis with their water.

The water crisis impacts everyone in the country in some magnitude; the biggest problem is sanitation. While all populations are affected by this, the rural population is hit the hardest. The challenge is as follows; 5 million of the rural population are unable to access clean water and a staggering 15 million lack access to basic sanitation ("Water in Crisis"). Multitude of problems stem from this with a major one being a presence of disease. In this aspect, the water crisis can target groups more specifically. The prevalence of water-borne disease is growing at an alarming rate due to the lack of sanitation. However, women and girls are more susceptible to waterborne illness ("Water in Crisis"). Women and girls are forced to walk the miles-long distance to fetch the daily water ration and face disastrous obstacles like the heat which can reach up to 104 degrees Fahrenheit (Chutel). Many often face heatstroke and by drinking the water in attempt to stay hydrated, they catch diseases. As well as striking people, the water crisis impacts the environment. With the water crisis causing a decrease in sanitation, the Vaal River, the largest

river in the country, has become “increasingly contaminated with fecal material” (“Water in Crisis”). Those who come in even small contact with the river have a high risk of infection.

South Africa’s hourglass is running out of time. The longevity of their country is dependent on the measures taken now to save their water supply before it is too late. With proper funding and supplies, the addition of solar-powered water purification systems could drastically change the position of intensity of the water crisis in little time by providing citizens to make use of contaminated water around them and alleviating the pressure to generate usable water that can supply all in South Africa.

Solar-powered water purification systems work to purify water and has been used variously in recent years. One way was with Deepika Kurup. When she was just 15 years old, Deepika invented a way to use titanium oxide and zinc oxide to help purify contaminated water with the help of ultraviolet rays (“6 Solutions to the Water Shortage Crisis”). The process works as exposing the two chemicals with UV rays initiates a reaction to form “hydroxyl radicals” to super oxidize the liquid; this process oxides the liquid to create water (Matus). According to Matus, Deepika’s experiment was tested with water contaminated with *E.coli* and coliform bacteria; the amount of *E. coli* dropped from 1,000 to none and 8,000 coliforms to less than 50 in less than 8 hours. It is clear that the experiment can remove high amounts of bacteria within water and deem it usable. The device is also extremely cheap to make compared to other purification devices and can be made in fast time as it uses simple supplies: cement, photocatalytic rods, reflective film, an glass bubbles made by 3M.

Besides just as an experiment, the device was implemented in Mexico and was put into real use. La Mancelona, a village in Mexico, went from a scarcity of water and business to a regular source of purified water and a profitable business. Using a similar engineered device by Purdue scientists, the village is able to produce 1,000 liters of clean water daily for 450 villagers (Treacy). The device is ran by subsistence farmers throughout the village who can effectively operate by themselves. The business is generating profit as the farmers sell 20 liter bottles for 5 pesos compared to their old methods of paying 50 pesos for regular bottles of water. Overall, the system brings in about $3600 per year. That money goes into helping the community with their other needs or for repairments for the device.
The use of solar powered purification systems reap supreme benefits for all involved. The technology is appropriate for South Africa’s situation as since the country is drastically lacking in clean water, it exists as a fairly quick way for people to transform polluted water into fresh, clean water for daily use.

With appropriate planning and funding, clean water for South Africa could be achieved. For the planning portion, the United Nations would serve as a good commissioner for the project. The United Nations was created in place to prevent conflict, maintain order, and protect every single country on Earth. With that being said, it is clear that such an organization would be the perfect fit to help a country facing an extreme conflict like the water crisis.

According to Megan Tracey, UN already has a similar plan in place with the systems; they have ordered 500 devices to be placed within Bangladesh to assist in their water crisis. The organization partnered with the Swedish firm called Watersprint to create the devices (“Portable Solar Powered Water Purification System”). The project is also backed up and applied by Muhammad Yunus, a Nobel Prize Laureate,

According to Tracey, Yunus' organization, Yunus Center, has ordered 10 units of the Watersprint portable solar powered water purification systems for a pilot program in rural communities of Bangladesh. Without a doubt, they believe that this system could eventually be put into use around the world with Bangladesh being the first step of a long road.

For funding, the United Nations could continue on with covering the price, or perhaps adding the World Bank into the project. The World Bank would serve as a great funding partner as they have funded countries in times of emergency need, such as Yemen, by providing a large grant of $50 million in their conflict situation ("World Bank Approves Grant to Help Communities and Institutions in Yemen"). South Africa's water crisis is clearly an ongoing critical emergency situation as well; they would need all the money they can receive as there is a slick amount of time before their taps run dry. If that is not enough, a similar company has been working to produce the same result of clean water in a neighboring African country.

While it has not been produced in South Africa, solar powered filtration systems are not foreign to Africa. In March 2014, the American company Pure Aqua Inc produced six filtration systems and placed them within Cameroon to purify their river water into usable drinking water ("Solar Powered Water Filtration Systems Headed to West Africa"). Their device works very similarly to ones described previously, and can produce up to 8 gallons of water per device. Pure Aqua's device is a rather larger one and would not be portable, unlike the ones in Bangladesh. However, the result is still identical: clean, usable, safe water.

It is an understatement that pain and despair will come to South Africa with Day Zero. Avoiding the severity of the crisis and continuing to wait for a plan will only spark a domino effect of other detrimental effects to the country. That can all be avoided within a short span of time. As there are no plans in motion to bring water to the country, the clear, temporary solution to South Africa's water crisis is to implement solar purification systems throughout Cape Town and cities across the country. The device allows a way to use the much of the contaminated water the country has. The device has deemed to be successful with the results other countries in similar situations have received. It has the power to provide such quick and needed results in the little time constraint the country has before all of the usable water disappears. Time is ticking.

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